Medetomidine alone and in combination with ketamine causes changes in the regional cerebral blood flow measured with single photon emission computed tomography in cats

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Aim

Intramuscular sedation or anaesthesia before intravenous tracer administration is frequently required in cats. Since anaesthetics have an effect on neuronal activity and on the circulatory system and hence on regional cerebral blood flow (rCBF), one should evaluate their effect on ^{99m}Tc-ECD distribution studies.

In veterinary medicine, medetomidine alone or in combination with ketamine is frequently used for intramuscular sedation or anaesthesia.

The aim of this study was to evaluate the effect of medetomidine and ketamine on rCBF measured with ^{99m}Tc-ECD.

Materials and methods

The rCBF was measured in 6 adult cats according to the following protocols. For the first protocol the tracer (^{99m}Tc-ECD) was injected in the awake cat, 5 to 10 minutes prior to IM administration of medetomidine (100 µg/kg) (condition A). For the second and third protocol the tracer was injected 15 minutes after IM sedation with medetomidine (100 µg/kg) (condition M) or with the combination of medetomidine (100 µg/kg) and ketamine (5 mg/kg) (condition MK). Anaesthesia was induced and maintained with propofol. Data were acquired with a triple head gamma camera (Triad, Trionix), equipped with multipinhole collimators (HiSPECT, Bioscan; 6 holes, 3 mm ∅, resolution 2.4mm). During the acquisition, which started 15 minutes after induction of anaesthesia, intermittent positive pressure ventilation was applied in order to maintain end tidal carbon dioxide ($EtCO_2$) between 35 and 45 mmHg. Differences between protocols were evaluated for nineteen regions: bilateral frontal, temporal, parietal and occipital cortex, bilateral thalamus, amygdala, basal ganglia and hippocampus and for the bulbus olfactorius, cerebellum and cingulate gyrus. These regions were predefined on MRI data (7T, Philips) fused with the µSPECT data. Semiquantification of the rCBF was performed by normalising the average regional counts to total counts.

Results

Registered counts were significantly higher in conditions M and MK compared to condition A ($P<0.05$). Tracer uptake in the M-condition was higher, albeit not significantly, in all brain regions compared to the MK-condition.

Significant higher perfusion indices were present in condition A in the subcortical regions (thalamus, amygdala, basal ganglia and hippocampus) ($P<0.05$) compared to the two other conditions.

Conclusion

Medetomidine alone or in combination with ketamine, prior to injection of ^{99m}Tc-ECD, provokes not only a generally increased tracer uptake in all brain regions, but also regional blood flow alterations. Thus caution is needed when evaluating rCBF under medetomidine or medetomidine/ketamine sedation/anaesthesia. Further studies are needed to evaluate the effect of these rCBF alterations on neurotransmitter studies.